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(56) Documents Cited

GB 2259143 A

US 5784036 A

US 5461361 A

US 4962998 A

US 4818048 A

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INT CL⁷ B60K 35/00, G02B 27/01

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(54) Abstract Title

Vehicle head-up display control

(57) In a vehicle having a head-up display, virtual images 6 of control elements, such as switches, are displayed and the functions associated with the virtual images are operated by the detection of the position of the index finger 4 of the driver within an operating area 3. The finger position may be detected by an image analyser receiving an image from a camera 2 or the operating area 3 may include a touch pad. A loudspeaker may signal the successful actuation of a control element 6 and output an acoustic warning if the hand of the driver leaves the operating area 3. The image of the control element also changes to indicate that it has been actuated.

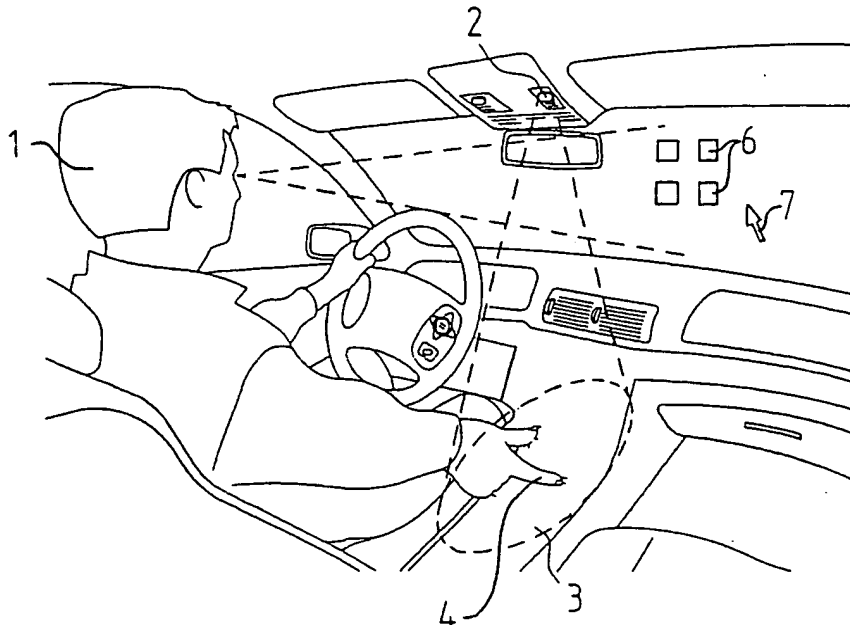


Fig. 1

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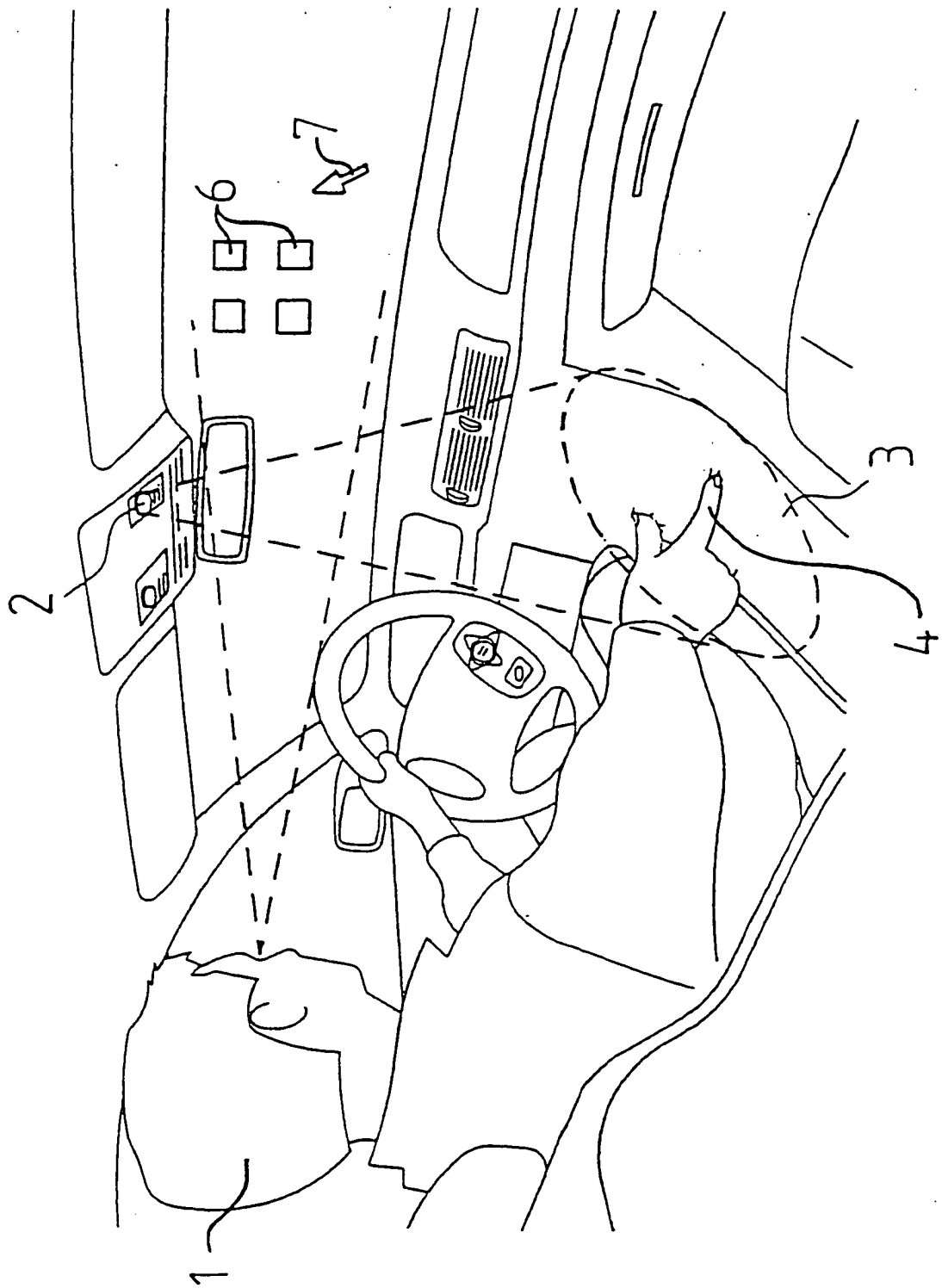


Fig. 1

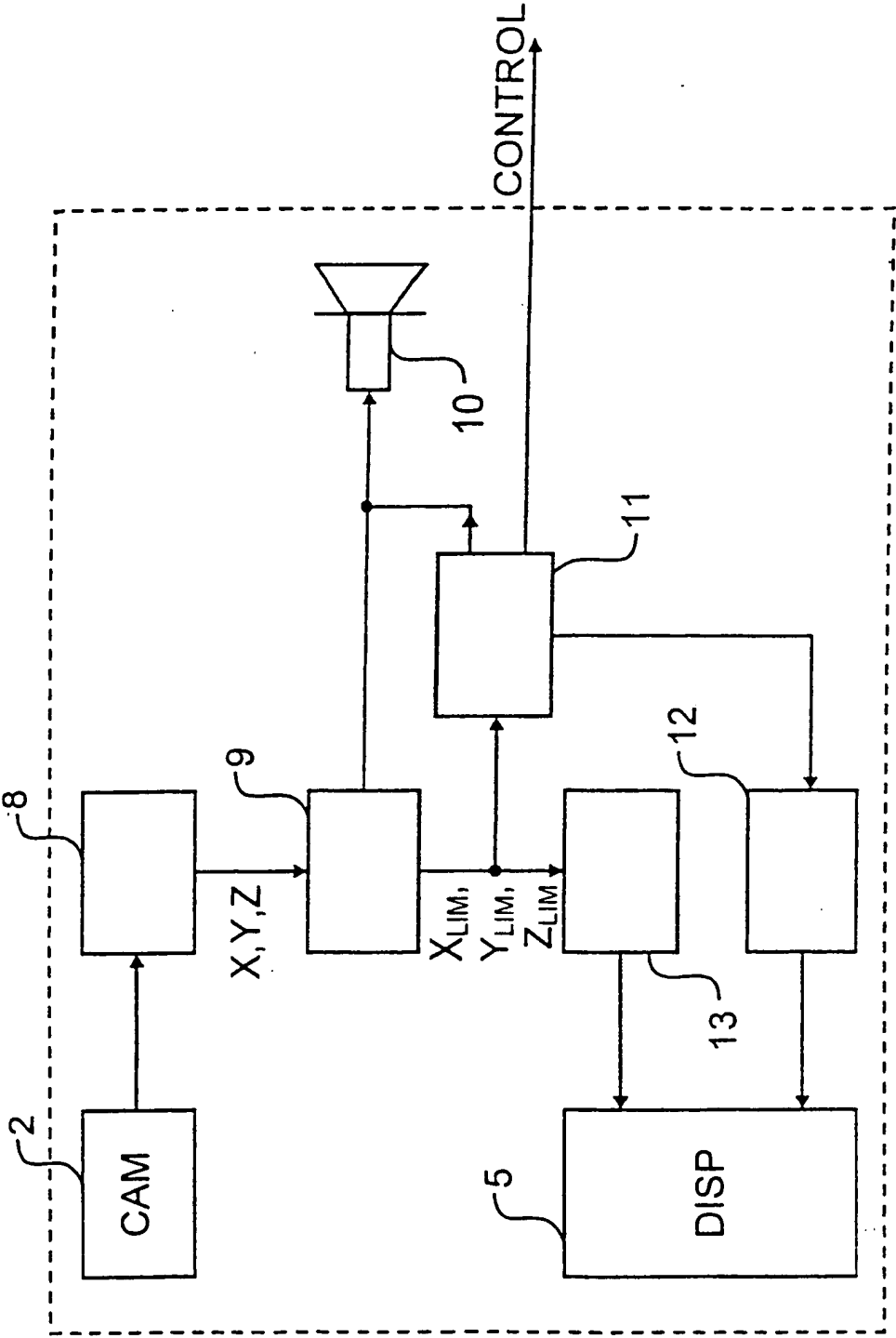


Fig. 2

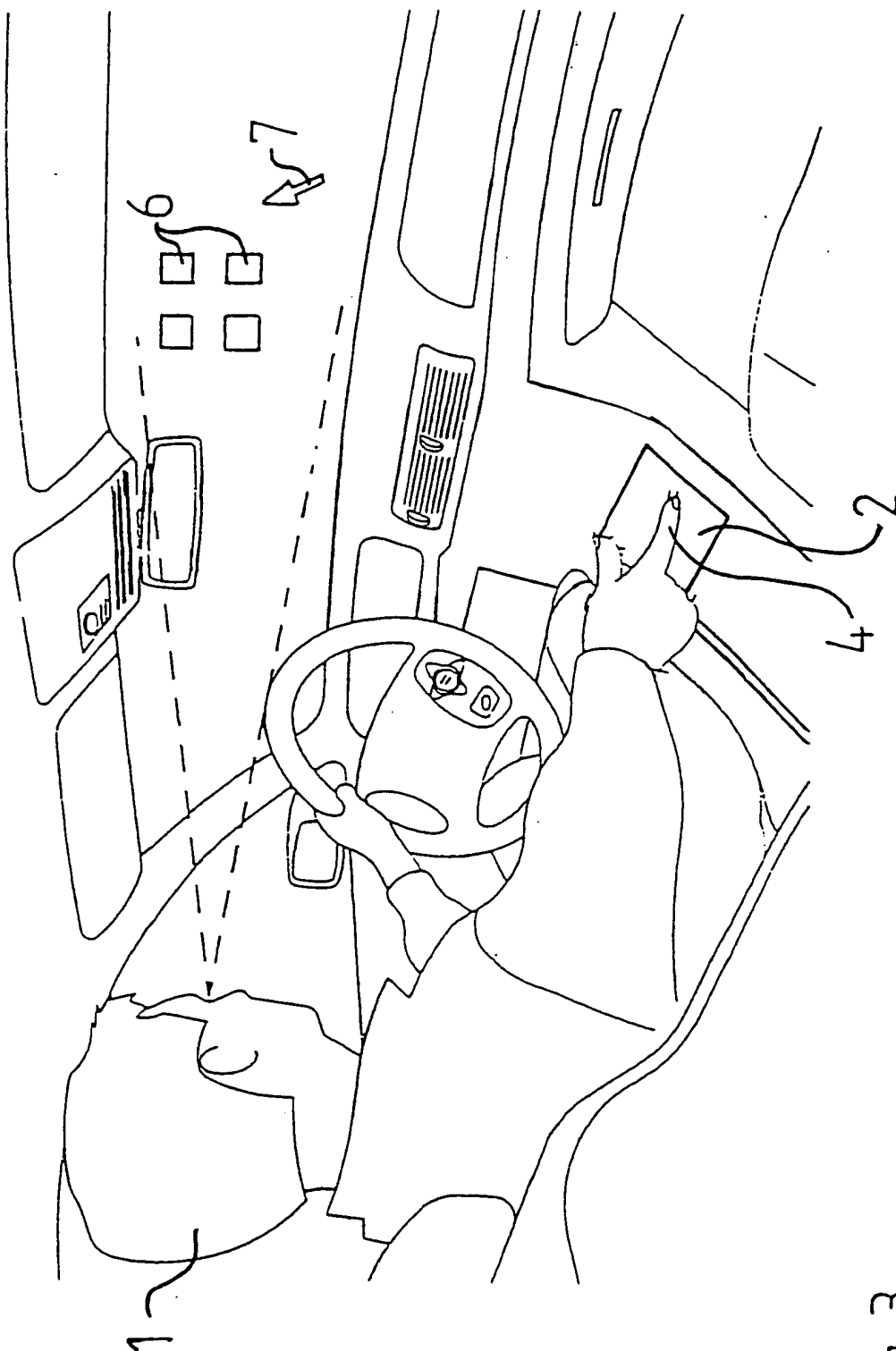


Fig. 3

CONTROL DEVICE

BACKGROUND OF THE INVENTION

The invention relates to a control device, particularly for minimum-distraction operation of switches in a vehicle.

From German Patent DE 196 53 595 C1 a control device is known which enables the driver of a vehicle to operate switches without the driver having to take his eyes off the road. For this purpose, this control device has a camera which is directed to the switches to be operated and thus takes a picture of the switches and of the driver's hand. This picture is projected into the driver's field of vision by means of a "head-up display", so that the driver can determine the position of his hand relative to the switches to be operated, without taking his eyes off the road. Equipment within the vehicle (e.g. climate control, radio, navigation system, telephone) can be operated in this way without endangering road safety. Furthermore, from the aforementioned patent, virtual control elements, such as switches, are projected into the driver's field of vision by means of the head-up display, so that real switches can be eliminated.

A disadvantage of the aforementioned control device according to DE 196 53 595 C1 is however, firstly the fact that the camera photographs not only the driver's hand and the control elements to be operated, but also, for example, parts of the centre console, which has a distracting effect when superimposed in the driver's field of vision. Secondly, the driver's hand may hide the control element to be operated from the perspective of the camera, and thus the superimposition of the driver's hand in his field of vision does not enable satisfactory operation.

SUMMARY OF THE INVENTION

The object of the invention is thus to provide an improved control device, with no distracting parts of the picture are superimposed in the driver's field of vision and enabling a good ergonomic operation.

This object is achieved by a control device, particularly for low-distraction operation of switches in a vehicle, which comprises a sensor for detecting the position of an input element manually guided by an operator, a visual display unit arranged in the field of vision of the operator, for display of at least one virtual element, an evaluation unit, the input of which is connected to the sensor, for determining the position of the manually-guided input element, and an image sensor, the input of which is connected to the evaluation unit and the output of which is connected to the display unit, for displaying a virtual image indicator in the field of vision of the operator, corresponding to the position of the manually-guided control element.

The invention is based on the general technical rule that the picture of the driver's hand taken by the camera is not to be directly superimposed in the driver's field of vision, but instead is to be used only to determine the position of the driver's hand. Then only a virtual image indicator corresponding to the position of the driver's hand determined in this way is superimposed in the driver's field of vision by means of a visual display unit, with distracting visual background signals in the picture taken by the camera, such as parts of the centre console, being hidden.

The sensor detects the position of an input element manually guided by the operator, whereby the input element, preferably is the hand or the index finger of the operator. It is, however, also possible that the operator holds a separate

input element that interacts with the sensor to enable the position to be determined. A suitable sensor would advantageously be a camera, particularly an infrared camera, an ultrasound sensor, a radar sensor, a capacitive sensor or a contact sensor, such as a so-called touch-pad.

The visual display unit is arranged in the field of vision of the operator to display at least one virtual control element and the virtual image indicator, whereby the display unit preferably consists of a "head-up display" that can project a picture directly into the field of vision of the operator.

In a preferred embodiment of the invention, the output of the evaluation unit is connected to a comparator that compares the position of the manually-guided control with the preset position data determined by the evaluation unit and generates a control signal relative to the result of the comparison. The preset position data in this case preferably corresponds to the positions of the virtual switch elements to be individually actuated, so that to trigger a switch actuation the user needs only to bring the manually-guided element into a required spatial area.

The output of the comparator is preferably connected to a loudspeaker to acoustically indicate a possible and/or implemented actuation of a virtual control. In this way it is, for example, possible to provide the operator with an acoustic feedback in that an acoustic signal is output when the manually-guided element is in an actuation position before a switch element. By hearing the acoustic feedback the operator then, for example, knows that all that is required is to press the manually-guided input element, such as the index finger, forward in order to activate the control element. After activating the control element a further acoustic signal which may differ from the first acoustic signal is then output to indicate the successful actuation of the control element.

In another embodiment the output of the evaluation unit is connected to a limiter that limits the position data, determined by the evaluation unit, of the manually-guided input element to preset values. In this way, for example, it is possible to prevent the virtual image indicator superimposed in the field of vision of the operator moving out of the field of vision in the event of a sweeping hand movement by the operator. The virtual image indicator then instead remains at the boundary of the field of vision to facilitate re-positioning by the operator. Preferably, the output of the limiter is also connected to a loudspeaker to provide the operator with acoustic feedback so that the loudspeaker outputs an acoustic warning signal if the hand of the operator moves out of the operating area.

Further advantageous embodiments of the invention are identified in the subclaims and explained in the following together with a description of the specific embodiments in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

- Figure 1 is a perspective view of the inside of a vehicle showing the control device in accordance with the invention.
- Figure 2 is block diagram of the control device in accordance with the invention.
- Figure 3 is another embodiment of the invention using a touch-pad as a sensor.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The perspective view shown in Figure 1 is of the inside of a vehicle with a driver 1 and a camera 2, arranged in the headlining above the centre console, which is directed downwards to an operating area 3 located in the area of the centre console. The the operating area 3 unlike normal control devices contains no actual switch elements or control elements, but instead serves merely as a contact area for an index finger 4 of the driver 1 acting as an input element. The picture of the operating area 3 taken by the camera 2 therefore essentially contains the position of the driver's index finger 4 as information.

Furthermore, the control device has a so-called head-up display 5, shown only schematically in Figure 2. Details of a head-up display 5 of this kind are given in German unexamined application DE 196 20 199 A1. No detailed description of the head-up display 5 is therefore given, but it is referred for these details to DE 196 20 199 A1, which is incorporated by reference. The head-up display 5 superimposes virtual control element 6 in the field of vision of the driver 1, whereby the virtual control element 6 can, for example, be a virtual switch. The head-up display 5 also projects a virtual image indicator 7 into the field of vision of the driver 1.

The output of the camera 2 is connected to an image analyser 8 which acts as an evaluation unit, that analyses the picture of the driver's hand 1 taken by the camera 2 and determines the spatial position of the end of the index finger 4 and outputs this in the form of X, Y, Z position data.

A limiter 9 is fitted in circuit after the image analyser 8 and compares the position data X, Y, Z of the end of the index finger 4, calculated by the image analyser 8, with the preset position data which forms the boundary of the

operating area 3. If the driver 1 moves the index finger 4 out of the operating area, the X, Y, Z position data of the end of the index finger 4 is limited to the limit values X_{LIM} , Y_{LIM} , Z_{LIM} at the boundaries of the operating area 3.

Furthermore, the output of the limiter 9 is connected to a loudspeaker 10 that outputs an acoustic warning signal if the hand of the user leaves the operating area 3.

The output of the limiter 9 is connected to a comparator 11 that compares the limited position data X_{LIM} , Y_{LIM} , Z_{LIM} with the preset position data corresponding to the virtual positions of the control element 6. If the driver 1 moves his index finger 4 such that the end of the index finger 4 is within the area of the virtual positions of the switch elements 6, the comparator 11 outputs a corresponding control signal CONTROL to trigger the function associated with the particular control element 6. In this case, the comparator 11 also activates the loudspeaker 10 to generate an acoustic feedback signal that indicates a successful actuation of the particular control element 6 to the driver 1. Furthermore, the output of the comparator 11 is connected to an image sensor 12 that controls the head-up display 5 for display of the virtual control elements 6. That control element 6 activated by the driver 1 is being displayed in a different colour after successful activation, so that the driver 1 has not only an acoustic feedback signal from the loudspeaker 10 but also a visual feedback signal by the representation of the control element 6 in the head-up display 5 in a different colour.

The control device further has an image sensor 13 that on the input end is connected to limiter 9. The image sensor 13 controls the head-up display 5 to display the virtual image indicator 7 relative to the X_{LIM} , Y_{LIM} , Z_{LIM} position data limited by the limiter 9.

The embodiment shown in Figure 3 is identical to those embodiments shown in Figures 1 and 2, with one exception as described below. Therefore same reference numerals are used, which have the same meaning in all figures.

The particular feature of the embodiment shown in Figure 3 is that the sensor 2 is not a camera but a contact-sensitive touch-pad that outputs the position at which the driver 1 touches the touch-pad 2.

The invention is not limited to embodiments described herein. A number of variants and modifications are also conceivable, that make use of the concept in accordance with the invention and therefore fall within the scope of protection.

CLAIMS

1. Control device, particularly for low-distraction operation of switches in a vehicle, comprising

a sensor (2) for detecting the position of an input element (4) manually guided by an operator and

a visual display unit (5) arranged in the field of vision of the operator, for display of at least one virtual element (6),

an evaluation unit (8), the input of which is connected to the sensor (2), for determining the position of the manually-guided input element (4), and

an image sensor (13), the input of which is connected to the evaluation unit (8) and the output of which is connected to the display unit (5), for displaying a virtual image indicator (7) in the field of vision of the operator, corresponding to the position of the manually-guided control element (4).
2. Control device according to Claim 1, wherein the output of the evaluation unit (8) is connected to a comparator (9) that compares the position determined by the evaluation unit (8) with preset position data and generates a control signal (CONTROL) relative to the result of the comparison.
3. Control device according to Claim 2, wherein for acoustic confirmation of a possible and/or implemented actuation of a virtual control element (6), a loudspeaker (10) is provided, whereby the loudspeaker (10) is connected to the comparator (9) for activation.

4. Control device according to anyone of the preceding claims, wherein the output of the evaluation unit (8) is connected to a limiter (9) that limits the position data determined by the evaluation unit (8) to preset values.
5. Control device according to Claim 4, wherein the output of the limiter (9) is connected to a loudspeaker (10) and that an acoustic warning signal is output if the preset position data is reached or overshoot.
6. Control device according to anyone of the preceding claims, whereby sensor (2) is an optical sensor, an ultrasound sensor, a radar sensor, a capacitive sensor or a contact sensor.
7. Control device according to anyone of the preceding claims, whereby sensor (2) is a camera, an infrared camera or a touch-pad.
8. Control device according to anyone of the preceding claims, wherein the visual display unit (5) is a head-up display.



Application No: GB 0119096.6
Claims searched: 1 - 8

Examiner: Tom Sutherland
Date of search: 5 November 2001

Patents Act 1977 Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.S): B7H (HNR)

Int Cl (Ed.7): B60K 35/00, G02B 27/01

Other: Online: EPODOC, JAPIO, WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	GB 2259143 A (MITSUBISHI) See Fig. 5, page 19 line 5 to page 20 line 3, A/T indicator 15 gives virtual image of manually selected transmission range.	1, 2 and 8.
X	US 5784036 (HIGUCHI et al) See Figs and col. 2 lines 11 to 16.	1, 2, 6, 7 and 8
X	US 5461361 (MOORE) See col. 3 lines 20 to 53.	1 and 8
X	US 4962998 (IINO) See Fig. 3 and col.3 lines 15 to 42.	1 and 8
X	US 4818048 (MOSS) Whole document relevant.	1, 2, 6, 7 and 8

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